

Organizational affordances

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Organizational Affordances: A Structuration Theory Approach to Affordances

Abstract. Affordance is an important concept in the field of HCI. There are various interpretations of affordances, often extending the original notion of James J. Gibson. Often the treatment of affordances in the current HCI literature has been as a one-to-one relationship between a user and an artefact. We believe that the social and cultural contexts within which an artefact is situated affect the way in which the artefact is used and the notion of affordance needs to be seen as a dynamic, always emerging relationship between people and their environment. Using a Structuration Theory approach, we conceptualize the notion of affordance at a much broader level, encompassing social and cultural aspects. We suggest that affordances should be seen at three levels: single user, organizational (or work group) and societal. Focusing on the organizational level affordances, we provide details of several important factors that affect the emergence of affordances.

Keywords: Affordance, HCI, Structuration Theory, Design, Artefact

Word Count: 12,529

Research Highlights:

- This paper provides a new perspective on the discourse of affordance with the use of Structuration Theory.
- It shows how affordance can be understood as “use” in situated practices (i.e. ‘technology-in-practice’)
- The Structuration Theory approach to affordances is showcased using two case studies.

1. Introduction

This paper explores a broader scope and treatment of affordances in order to develop a better understanding of designed artefacts and technologies. In the field of HCI, James J. Gibson's (1979) notion of affordance has been used to understand usability problems. In several approaches that conceptualize affordance, its treatment has been merely as a one-to-one relationship between a user and an artefact or technology (Norman, 1999; Gaver, 1991). However, when an artefact or a technology is situated in a large organization, where it is used and is affected by more than one user, it becomes important that a broader view of affordance is considered which encompasses social and cultural aspects of work organizations.

Gibson's intention behind coining the notion of affordance was to refer to a phenomenon that indicated the complementarity between animals and their environments. His original notion was strictly tied to the ecological psychology, limiting it to the 'offerings' or 'action possibilities' in the environment in relation to the action capabilities of an actor. When the term was introduced to the HCI community by Norman (1988) and subsequently by Gaver (1991) and others, its intended use was to support usability and ease-of-use in digital and physical artefacts. These accounts were cognitivist in nature, which conceptualized affordance as perceived properties of the environment that relay on the experience, knowledge, and cultural understandings of the actors. Recently, the dimension of activity and practice was also introduced to the notion of affordance, utilizing activity theory (Bærentsen and Tretvik, 2002) and phenomenological (Turner, 2005) perspectives. In this paper, we attempt to broaden the treatment of affordances by going beyond one-to-one relationship with artefact or device centric understanding to focusing on the social and contextual aspects.

We use the Structuration Theory as an approach to guide our understandings of affordances. Structuration Theory was proposed by Anthony Giddens in his work of "The Constitution of Society" (Giddens, 1984). Structuration Theory provides an understanding of how social systems are created and reproduced through the social structures and human agents. Of particular interest is the notion of 'technologies-in-practice' by Orlikowski (2000) – who extended Giddens' work on Structuration Theory. Technologies-in-practice refers to people's enactment vis-à-vis a system or a technology leading to the emergence of social structures. To put it simply, the notion of technologies-in-practice suggests that different uses of a system can emerge based on the ways people enact with it. This is quite relevant to the idea of affordances, where using Orlikowski's (2000) Structuration Theory approach, we can conceptualize affordances as a notion that emerges in people's situated practices and is affected by the social and cultural issues that surround it. With this view, designers may have inscribed certain meanings and uses of a technology, but it is the way users use that technology in a certain cultural and social situation determines its affordances. Our Structuration Theory approach to affordances gives primacy to practice and situatedness of a technology in a particular setting, without ignoring its material properties.

After conceptualizing affordances from a Structuration Theory point of view, we introduce three levels to explore a broader understanding of affordances: single user, organizational (or work groups) and societal levels. The user level affordance is concerned with the one-to-one relationship between a user and an artefact. It focuses on how a user in a given situation uses and adapts to the technology and continuously form and re-form certain affordances. The organizational and societal affordances are concerned with the one-to-many or many-to-many relationship between artefact(s) or technology and users in organizations and in the overall society, respectively. Our main interest in this paper is focus on the organizational level. Our use of Structuration Theory allows us to apply the factors that need to be considered for developing

better understanding of organizational affordances. These factors or conditions (technological, interpretive, power and cultural) affect the ways a technology is enacted in a specific organizational setting and hence its affordances.

The term ‘affordance’ has been stretched in the HCI literature way beyond the very tight meaning introduced by Gibson (e.g. (Bærentsen and Tretvik, 2002; Turner, 2005; Vyas et al. 2006)). This paper continues this stretching of meaning and arguably does so far beyond its original meaning. However, the meanings we attach to the term are continuous with other recent work (Turner, 2005; Kaptalinin and Nardi, 2012; Sun and Hart-Davidson, 2014) and without an alternative more generic term it seems the most appropriate word to use. In addition, at each level, like Gibson’s original affordances, we are concerned with the fit between a technology and an individual or group; how the relationship allows/affords some particular set of actions or activities.

Why a Structuration Theory view on affordances? Technology is becoming more complex and at the same time becoming more equivocal and therefore allowing a space for multiple user-interpretations and multiple plausible actions. This is especially the case in groupware technologies and systems that allow multi-party interaction. From a designer’s point of view it becomes really difficult to understand how users in large organizations adapt and appropriate these technologies as they offer unbounded (but not infinite) possibilities. We believe that adding the notion of group dynamics to affordance could facilitate designers to see a holistic picture of the technology use and hence the improvements in technology design. There is obviously an extensive literature on ethnography and other research focusing on social and contextual issues (Anderson, 1994; Heath and Luff, 1992; Hughes et al. 2000), but affordances have not been treated in this way before except insofar as some aspects of cultural perceptions have been considered, such as the ‘push’ affordance of screen-based ‘buttons’ (Norman, 1999).

The main contributions of this paper are twofold:

- We provide a conceptualization of affordance based on the Structuration Theory, which will allow researchers to look at affordance as ‘use’ rather than ‘action possibilities’. Such an approach to affordances can be useful to study technology use in large organizations where social and cultural dynamics are at play.
- Going beyond the theoretical relevance, we showcase the usefulness of our approach by applying it in two different contexts: the Dutch tax office and a multinational bank. We show that the use of ‘organizational affordances’ as an analytic tool can allow researchers and designers to understand how technology affordances can be studied in complex and dynamic situations.

In the rest of the paper, we will first provide a brief background research and related work on affordances, in section 2. In section 3, we will describe the Structuration Theory approach to affordances and elicit its characteristics. Here we will introduce three rough levels of affordances, namely, user level, organizational level and societal level; and focusing on the organizational level affordance will provide details of four factors (or conditions) that play an important role in forming affordances as an emergent phenomenon. In section 5, we will provide details of two case studies where our notion of organizational affordances is used to understand the technology situated in large organizations. In section 6, we provide details of several design considerations and discuss our approach and conclude that affordances are not just the ‘mediator’ or human action but also the ‘product’ of human actions.

2. A Short Background on Affordances

We will briefly review some literature on affordance, including Gibson's original notion, and move onto the latest developments on conceptualizing affordances in a much broader sense. For a comprehensive review of the concept of affordance, we point to the work of Kaptelinin (2014).

Gibson defined affordance as, "the affordances of the environment are what it offers the animal, what it provides and furnishes, either for good or for ill" (1979, p.127). Having its origin in perceptual psychology, affordances were described as a shared relationship between humans and the world – "something that refers both to the environment and the animal in a way that no existing term does." According to Gibson, an important fact about affordances is that while they are in a sense objective, real and physical, unlike values and meanings, they are neither an objective property nor a subjective property. They are both a fact of the environment and a fact of embodied behaviour that exists only in the relation between them. "An affordance is for a species of animal, a layout relative to the animal and commensurate with its body.... What animals need to perceive is not layout as such but the affordances of the layout" (p.157). Gibson's intention behind affordance was to refer to the action possibilities offered by the environment to an individual, regardless of the individual's ability to perceive and realize this possibility. However, Gibson also went on to claim that the perception of creatures (suitably evolved to their ecological niche) will be such that the action potential is 'immediate' to perception, not requiring explicit interpretation or reasoning.

Norman (1988) introduced the concept of affordance to the HCI community as a design aspect that informs users how an object should be used. According to his definition, "the term affordance refers to the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used. A chair affords ('is for') support and, therefore, affords sitting. A chair can also be carried". [p.9] This way Norman's conceptualization of affordance fundamentally differed from Gibson's definition reflecting on the fact that affordances depend on the way they are perceived by the users, tightly attaching affordances with users' knowledge, skills, experience and culture. To Norman, affordances provide cues to utilize properties of objects. Norman (1999) later distinguished between perceived and real affordances and suggested that it was the perceived affordances that determine the usability of an object. Note also the words 'is for' – in Norman's use of the term affordances can be designed into an artefact, an issue we return to in section 4.

Several attempts have also been made to further enhance and clarify the notion of affordance, most notably by Gaver (1991), McGrenere and Ho (2000) and Hartson (2003). Gaver followed the cognitivist view as initiated by Norman. His aim was to use the notion of affordances to understand the strength and weakness of technologies with respect to the possibilities these offer. By introducing perceptible, hidden and false affordance, Gaver (1991) differentiated between affordances and information that suggests certain affordances. Gaver believed that to be able to understand the ease-of-use of a technology, affordances should be differentiated from the perceptual information about them. He introduced the concept of sequential affordances. Sequential affordances refer to 'exploration', meaning how certain affordances may reveal over time. To be specific, Gaver's sequential affordances refer to the situations where a user's action on affordances leads to certain new affordances.

In addition to their critical reviews on other seminal literatures on affordance, McGrenere and Ho (2000) further explored the hierarchical nature of affordances. They state, "it is important to note that affordances exist (or are nested) in a hierarchy and that the levels of the hierarchy may or may not map to system functions" (p.185). They suggest that affordances are not binary; these

should be seen in a two-dimensional space: the ease with which an affordance can be undertaken and the clarity of the information that describes the existing affordance.

By taking a closer view, Hartson (2003) categorizes affordances into four complementary types: Cognitive, Physical, Sensory and Functional. Cognitive affordances correlate to Norman's perceived affordances and physical affordances relate to his real affordances. In addition, Hartson also addresses properties of stimuli that a user senses (i.e. sounds, texts, lights) by introducing sensory affordances as a design feature. Functional affordances are defined as, "a design feature that helps a user accomplishes work, i.e., the usefulness of a system function" (p.323).

Recently, several attempts have been made to re-clarify and expand Gibson's original notion of affordance, most notably the philosophical view initiated by Turner (2005) and the Activity Theory approach to affordances by Bærentsen and Trettvik (2002). Taking a phenomenological account, Turner suggests that in addition to the 'simple' affordances (as Gibson's original version of affordance), designers should also take into account the 'complex' affordances that include issues such as history and practice. Bærentsen and Trettvik argue that the phenomenon of affordance only exists when a user is actively involved in interaction with a system. To them, user's active participation with the system is an important determinant of its affordances. Hence, affordance is an emergent property of the material world.

The approach of Turner and Bærentsen and Trettvik can be labelled: interaction-centred, as they emphasize the fact that affordances of a system emerge during users' actual interaction with it. Unlike the cognitivist views (Norman 1999; Gaver 1991), from the interaction-centred view affordances of an artefact are the possibilities for, both, thinking and doing, which are signified by its users during their actual interaction with the artefact. Users actively participate in the interaction with the artefact, continuously interpret the situation, and construct or re-build meanings about the artefact. From the interaction-centred view, affordances are not the pre-determined properties of a technology but a relationship that is socially and culturally constructed between the users and the artefact in the lived world. This view also suggests that affordance is an interpretive (in addition to the behavioural) relationship between users and the technology that emerges during users' interaction with the technology in the lived environment.

In our earlier work (Vyas et al., 2006) on affordances, we proposed an 'interaction-centred approach' to understand affordance. The interaction-centred view of affordance suggests that affordance is an interpretive relationship between users and the technology that emerges during the users' interaction with the technology in their lived environments. We developed two broad categories of affordances: 'affordance in information' and 'affordance in articulation'. Affordance in information refers to users' understanding of a technology based on their semantic and syntactic interpretation. This is in line with Gibson's notion of affordance. Affordance in articulation refers to users' interpretations about the use of the technology, which is a highly situated notion that emerges over time. In this work, we indicated that there is a strong need for HCI researchers to think about affordances beyond the artefact-level and look into the practices around artefacts.

Dohn (2009) looks at the way 'affordance' is used in the computer supported learning community, which has borrowed interpretations from HCI. This work takes a more material focused view of action drawing on Merleau-Ponty's (1962) 'body schema', although, like Turner and Bærentsen and Trettvik, also seeing this in socio-cultural terms, not merely physiological.

Kaptelinin and Nardi (2012) provide a 'mediated action perspective' on affordances. The authors adopt the Vygotskian socio-cultural approach (Vygotsky, 1978) that emphasizes humans acting in their cultural contexts. The central idea in their conceptualization of affordance was that

human activities are mediated by culturally developed tools such as a technology, hence, going beyond Gibson's original notion of affordance that focused on the 'natural' environment and including the 'cultural' environment of humans. The authors present different types of affordances: instrumental (involving being able to 'handle' an instrument and causing 'effect' on it), auxiliary (determined by the embeddedness of a technology in a web of mediators) and learning (a chain of linked actions that lead to completion of a user's goal).

Very recently, Sun and Hart-Davidson (2014) developed a 'relational approach' to study affordances. The authors bring key concepts from communication studies and organizational studies to develop a framework of affordances that bind the material and the discursive to help researchers address design issues such as power, cultural values, performed identities, mediated agency, and articulated voices. Sun and Hart-Davidson draw on some similar sources to our own analysis, including Orlikowski (2000); however, in our work we focus more specifically on structuration theory.

Several of these more recent analyses of affordance share a shift towards emphasising that the environment of human action is not just physical, nor even simply digital or technological, but also intrinsically social, cultural and organisational.

3. A Structuration Theory Approach to Affordances

In this section, we will develop a Structuration Theory approach to affordances.

3.1 Structuration Theory

Anthony Giddens developed Structuration Theory in his seminal work titled: "The Constitution of Society" (Giddens, 1984). It is one of the most employed frameworks within social science research for investigating the use of technology by groups or organizations. Structuration Theory establishes a link between 'social structures' and 'human actions'. It considers that social structures not only constrain human actions but also enable them. Human action has transformative capacity, in that, it can create and regenerate social structures in a particular setting. Humans do realize that their actions have a certain conditions and consequences (inscribed by social structures) and not all the conditions and consequences are explicit. Giddens considered social structures and human actions as two sides of one whole. To Giddens, it is through communication, using power and giving sanctions, that social structures are produced and (over time) reproduced via human actions.

There are two views in which Structuration Theory can be applied to understand the use of technology in practice: 'appropriation' and 'enactment'.

The *appropriation*¹ view is used by approaches that focus on structural properties of a technology (e.g. DeSanctis and Poole, 1994). They observe how users, during their interaction with the technology, adapt their social structures to the technology. Orlikowski (2000) proposes the enactment view and states that social structures are instantiated only through actions and practice. They cannot be seen as purely embedded into the technology. So, properties of a technology may not be useful to determine social structures, as they are external to the human actions. Orlikowski suggests that users do not just use the technology as it is given. Users may

¹ The use of the word 'appropriation' in the context of Structuration Theory is not the same as what we often see in HCI research (Dix, 2007) that refers to users' ability to use a technology in her/his own way. In fact the HCI use of 'appropriation' is closer to Orlikowski's 'enactment'.

ignore certain properties of the technology (Pliskin et al. 2000) while they interact with it, or invent new properties beyond designers' expectations (e.g. a Fax machine used as a photocopier). Users may modify the way a technology should be used after it is designed. The repeated and on-going interaction of users with a technology determines the production of structures of technology use, the so-called technology-in-practice.

Orlikowski (2000) proposes three conditions that lead to technology-in-practice: interpretive schemes, institutional (norms) and technological (facilities) conditions. Each of these three aspects corresponds to Giddens's levels of modalities from the duality of structure scheme (Giddens, 1984). Although addressing the issue of power (when discussing facilities or technological conditions) Orlikowski does not discuss this issue in depth. Other authors (e.g. Hayes and Walsham, 2000; Massino and Zamarian, 2003) focus exactly on this issue, showing the importance of looking at how, for example, managers (heteronomous control) as well as employees (autonomous control) can influence the use of a system. Therefore, Chisalita (2006) uses 'power' as a condition in her adaptation of the Structuration Theory to study the use of technologies in organizations.

If we interpret Gibson's original view of affordance with respect to technology design, the ways of using a complex technology, for example, is directly perceivable from the technology itself. His notion was limited to supporting mainly the perceptual level considerations (e.g. representations, dialogue, functionality), without attending to the actual use of the technology. Additionally, there was a minimal relevance to users' social contexts. In order to understand technology use and to improve our design understandings, we believe that a broader view of affordance is required.

Take fax machines for example. When the first fax machine was invented, its main functionality was to allow its users to send and receive Faxes. Overtime, however, users' understanding of the fax machine evolved as they learnt to use it for photocopying. Photocopying can be considered as a side effect, rather than a major functionality but through users' involvement and long-term acquaintance, the fax machine 'afforded' photocopying. Of course, humans adapt their environments for themselves and for others; in particular often using these appropriated affordances as design inspiration. As a result we now see a machine comprising of fax, photocopying and scanning facilities.

From the enactment view of the Structuration Theory, we can say that a specific format of technology use (technology-in-practice) determines what the technology affords. Affordances of a technology emerge through this continuous process of technology affecting human actions and human actions affecting the technology use. In this way affordances refer to the behavioural and interpretive forms of people's situated use of the technology. This means that affordances do not just have behavioural forms, e.g. "how to physically grab something" but also interpretive forms as to "what that thing means."

During technology use, users adapt and re-structure their (shared) working practices; hence users' understandings of what the technology does and symbolizes may also emerge over time. We believe that affordances should not be seen as static properties of a technology.

3.2 Technology Duality and Interpretive Flexibility

In this section we will look at the role of a technology from a Structuration Theory point of view and highlight its dual nature and interpretive flexibility.

From a Structuration Theory view, technology is seen both as a product of human actions within a specific socio-cultural context and a medium for actions due to its material and social properties inscribed into them by designers. Users may not use a technology as it was designed by its designers, they may ignore some properties, work around or invent new properties, sometimes contradicting the assumptions of its designers. In Structuration Theory, ways of using a technology is instantiated in users' practice. Interpretive flexibility (Bijker, 1987) of a technology plays an important role here. Interpretive flexibility can be seen at two levels: design mode (meanings attached by designers at the time of developing a technology) and use mode (meanings constructed by users during the situated use of the technology). Different technologies have different levels of interpretive flexibility, as material characteristics of the technology, characteristics of human agents (e.g. knowledge, motivation, experience) and characteristics of the context within which the technology is being used.

Historically, in HCI, systems are built to convey designers' meanings and interpretations to the users (Sengers and Gaver, 2005). The designers determine what possibilities or opportunities should be offered to the users. From a design perspective, this suggests that designers can premeditatedly decide what affordances (possibilities for different activities) of a system should be offered to users (Norman 1999; Gaver 1991). During the technology use, however, users do not just passively receive information. They actively participate in the interaction and also add to this interaction, sometimes beyond what is offered by the designers. There has been some work looking to create less fixed interfaces, for example de Souza's (2005) treatment of interaction as an unfolding, but designed, semiotic engagement between user and designer's surrogate or Dourish's (2001) proposal for embodied interaction that is designed to be more open to interpretation and (from an HCI perspective) appropriation. In addition Participatory Design (Schuler and Namioka, 1993) practices do offer an opportunity for users to have their say in the design process. Nevertheless, seeing affordances as a dynamic relationship between users and artefacts would allow designers to overcome the above mentioned historical limitation.

3.3 Dynamics of Affordances – A Broader Picture

As discussed in the previous section, once we move from a very bare view of the physical affordances of natural objects, we inevitably have to take into account a network of social and ecological effects including many that change the nature of the available artefacts and affordances of them. In this section, we will provide a broader picture of affordances focusing on their dynamics and evolution.

Figure 1 around here

Figure 1 captures some of the dynamic interactions between users and their situated use of artefacts. The cycle (1) shows the simple pattern of artefacts having affordances perceived by a user (or in collaborative situations group of users) who then act on them. However, performing an action changes the situation (2), both physically, but also cognitively and culturally: for example a user may become aware of more possibilities (existing affordances) as a result of using an artefact.

In particular, the perception and acting out of affordances may lead to reflection (3) on the artefacts, their uses (potential actions) and people's roles (constraints upon actions). Once users are aware of this their perceived affordances change also.

Furthermore, knowledge of the potentialities of artefacts and materials may lead (4) to modifications of artefacts, design of new artefacts (e.g. tools), which then change the environment both by their own existence and because of the changed affordance of pre-existing objects (e.g. a round stone affords building once you have tools to dress it). This cycle of change leading to modifications of artefacts is central to some of the notions of Ilyenkov (1977) as applied to affordance by Turner (2005). In particular Ilyenkov sees the creation of physical artefacts and tools as embodying practices of a community, claiming that the artefacts that we have and their affordances embody cultural norms and values. (E.g. George Orwell's novel 1984 describes a fictional language called Newspeak, which constrains the English language to only the acceptable topics – thus representing the social culture of the totalitarian regimes.)

From this discussion, and explicit in Figure 1 are the three rough levels of affordance we have mentioned earlier:

- (i) single user,
- (ii) organization (work-group or community of practice), and
- (iii) culture / society.

We say that this is a rough categorization as once we get beyond a single user in isolation (which never happens), there is a continuum of effects. Given this caveat, at each of these levels we can see effects of learning and change. At level 1, users build their knowledge of what is possible through action and reflection, but in addition may become more skilled and thus increase the theoretical (Gibsonian) affordance: for example, a unicycle does not afford movement (except downwards) unless you have sufficient skill. It should be emphasized that the environment-body relationship is (a) dynamic, so that as physical capabilities change (e.g. as a creature grows, or is injured) affordances change; (b) depends on skill not just raw prowess (e.g. a rock face may afford climbing to an experienced climber, but death to another); and (c) also depends on mental knowledge/ability (e.g. a calculator only affords adding up if you recognize Arabic numerals and their meaning).

At level 2, ethnographies have repeatedly shown us the importance of overhearing or overseeing other people's activities (Heath et al. 1992) and the way we shape our actions for other people's overseeing. So as we act we influence others, and they learn about possibilities for action. In addition we may explicitly talk about action possibilities and train others in skills. Importantly, at organizational level the four conditions as claimed in the Structuration Theory are also applicable: technological, cultural, power and interpretive. This is where organizational affordances are placed, which emphasize on how organizations (and those four conditions) affect the ways in which a technological artefact is used. Finally at level 3 cultural understandings (e.g. the light switch) influence perceived affordances and norms and roles may alter what people feel is possible or alternatively engender rebellion.

Furthermore, as noted, the actions or activities afforded by an object (or objects) may be about what actions can be performed in concert with others and this may vary from ad hoc collaboration (a stretcher affords carrying by two people) that is closest to level 1, to higher level effects. At level 2 we might say that a mobile phone affords communication, but only if a group of people all possess one, or at level 3 that stones afford building into pyramids, but only by a society of a particular level of sophistication and political type.

The principle difference between levels 2 and 3 is in extent: level 3 effects are long term and typically cover one's interactions and experience, whereas at level 2 interactions may change more rapidly. Normally, level 2 has a tangible 'boundary', e.g. an organization, office-group. Even when new members come in or old members leave and working practices change, the affordances remain specific to that organization or working group. On the other hand, at level 3, knowledge about artefacts is gathered from birth or learnt over time. However, as we have said the true picture is more complex, for example, a mediaeval guild had long term effect on the development of various crafts and their toolsets. **Another complex example is a family group, which in size terms is more at level 2, and yet is relatively stable in composition and may have customs and practices that span generations, sharing qualities with level 3.**

Organizational affordances by definition belong to level 2. However, as we showed in figure 1, both level 1 and level 3 interactions have strong effects on organizational affordances. The four contextual conditions (described in the following section) are also more prevalent in level 2 as they are very specific to organizational settings.

3.4 Factors Affecting Organizational Affordances

Chisalita (2006) proposes four conditions as the main factors that may affect the emergence of affordances of a technology: technological, cultural, power and interpretive conditions.

- *Technological conditions*: These refer to the functionality, design features and infrastructure of a technology. In a dynamic technology (such as an Intranet) the technological conditions may also include changes in the technology and the frequency of those changes. Technological conditions influence the emergence of affordances, by providing the technical facilities of work and social interaction.
- *Cultural conditions*: These refer to beliefs and values held by a group of people concerned with a technology. In a big organization different subcultures may appear (e.g. team/departmental/professional) (Trice and Beyer, 1993). Depending on the values and beliefs of people, technology may be perceived affording different possibilities.
- *Power conditions*: Usually the concept of power is used to refer to formal power – the relation of dominance among different classes of actors based on their hierarchical positions. It is important to note here that power does not have to be just top-down. We consider that power can also be constructed in a bottom-up way (Fox, 2000). This means that even a group with no formal power can exercise power by bringing changes in the organizations. With regards to the use of technology, power can exercise different social influences on the emergence of affordances like: changing access to applications of technology as regulated by laws; changing the way technology has to be used; changing the way technology use is controlled; etc.

- *Interpretive conditions*: The interpretive conditions refer to members' knowledge of, and attitude towards, the technology. It also refers to the meanings attached to technology (Chisalita, 2006).

In fact, these conditions represent the 'context' in which a technology is used. The conditions are reinforced or sometimes changed (even the technological ones) by the very use of technology in a particular way. Due to the fact that these conditions influence the emergence of ways in which technology is used in a particular setting, they can also be interpreted as factors that influence the emergence of affordances of a certain technology.

It is important to understand that all the conditions mentioned above have a combined influence on the emergence of affordances. There is no situation in which one condition influences the emergence of affordances in an independent way. These conditions constitute the context; and the emergence of a certain affordance can reinforce the conditions or, in some cases, change them. The two cases, described below, will provide a deeper understanding and refinement of these conditions.

3.5 Characterizing organizational affordance

Based on the above discussion, we will build towards a comprehensive characterization of organizational affordance.

As shown in figure 2, according to the Structuration Theory the situated actions of human agents produce and reproduce social structures and in the same way human actions including work processes are enabled as well as constrained by the social structures. According to Giddens human actions take place in certain implicit or explicit conditions such as interpretive, power and norms. The possibility for humans to perform actions in a particular social situation is at the centre of the Structuration Theory.

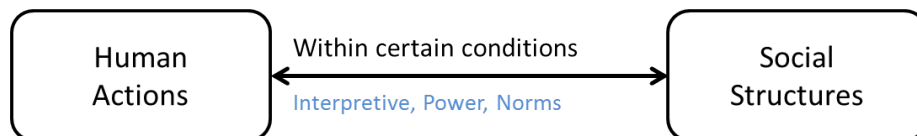


Figure 2: A simple representation of Giddens's Structuration Theory

If we move to Gibson's notion of affordance, it is the human action possibilities offered by a given environment (be they physical objects such as a fax machine or a social system such as an organization) are termed as affordances.

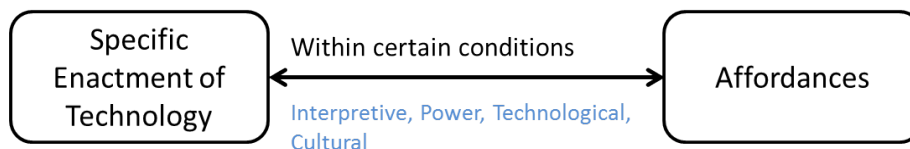


Figure 3: Organizational Affordances using the Structuration Theory

Figure 3 represents the Structuration Theory approach to affordances – which we term as organizational affordances. Here specific ways of using a technology (i.e. enactment) within a particular context (within the four conditions: interpretive, power, technological and cultural) would enable certain affordances with or through the technology. Similarly, these affordances

will continuously enable certain new ways of enacting during future interactions. From the Structuration Theory perspective, a specific format of technology use (technology-in-practice) determines what the technology affords. As this technology use changes new affordances will emerge. The four conditions are quite inherent to the technology use: changes in any of these conditions will affect the technology use and that will in turn also affect the affordances.

Let's revisit the example of a fax machine to make things a bit clearer. In a real-world setting one cannot conceptualize a fax machine as an isolated object that offers faxing (and photocopying or scanning) a document. The context and the situated use of the fax machine in a given setting definitely shape certain affordances. The Structuration Theory approach to affordances shows that even though the 'appropriated' use of the fax machine offers photocopying, in an organizational setting certain norms may dictate that employees may not be able to use the fax machine for photocopying purposes ('cultural condition') or the proximity of the fax machine close to somebody of a higher position in the organization may not afford photocopying ('power condition'). This is not to say that the fax machine's properties or features have changed. But from a Structuration Theory point of view the use and organizational conditions determine the affordances of a technology. Similarly, when the conditions in the environment change, e.g. if a new management informs employees that they can use the fax machine for photocopying as long as it is stocked with new papers, the affordance of the fax machine also changes.

In the following we provide specific features of organizational affordance:

1. ***Affordance as 'Use':*** It is important to note that the Structuration Theory approach to affordances conceptualizes affordances not only as action possibilities vis-à-vis a technology but as the actual use – enacting with the technology. This way it gives primacy to practice rather than the attributes or features of the technology. This kind of conceptualization of affordance comes close to Phil Turner's 'affordance as context' – where the author has suggested that "affordance, use and context are one". Turner obviously used a completely different perspective to arrive at this conclusion.
2. ***Affordance as an 'Episode':*** Another point that we would like to communicate strongly with our conceptualization is that the affordance of a technology refers to an episode or an instance of users' interaction with the technology. The episode can be repeated yielding the same sort of affordances or with any changes in the enactment with the technology or any changes in the conditions may lead to changes in the affordances. This shows that organizational affordances are quite fluid and they often emerge over time.
3. ***Affordance has four conditions:*** This has been already made clear earlier that the interpretive, power, technological and cultural conditions play important role in enabling with the enactment as well the affordances of the technology. These four conditions are quite central to the Structuration Theory approach. Any changes in these conditions or a combination of them can mean changes in the affordances.

Our conceptualization of affordances is in line with recent work of Bærentsen and Tretvik (2002), Turner (2005) and Kaptelenin and Nardi (2012) on at least on two points: *agency* and *context*. Central to Gibson's affordances was the 'action possibilities' offered by the environment (or an artefact). The position taken by Bærentsen and Tretvik (2002), Turner (2005), Kaptelenin and Nardi (2012) is influenced by Vygotskian (1978) and Ilyenkovian (1977) socio-cultural approach that treats human actions as mediated through culturally developed tools and artefacts. Kaptelenin and Nardi's (2012) mediated actions perspective regards affordance as a three-way

relationship between actors, the mediational means (tools incorporating a certain culture) and the environment. Changes in either would lead to different kinds of affordances. Our Structuration Theory approach to affordances also acknowledges the aspect of agency, through which users can enact onto the environment. Rather than looking at agency through the point of view of physical action possibilities, our approach treats agency as use or enactment. We also acknowledge that different (or even the same) people can have different enactment towards the environment, which may lead to different affordances.

Another point of similarity is the way the aspect of ‘context’ is treated. The way, for example, Turner (2005) treats affordance as relying largely on the contextual aspects, our approach also gives primacy to the contextual issues. We borrow four contextual conditions from the Structuration Theory. Although largely associated to organizational settings, these contextual conditions play an important role in enabling human actions and subsequently the affordances. To us, affordance is a relationship between the human agency and the four contextual conditions.

Our approach differs with the likes of Gaver (1991), Hartson (2003), Turner (2005) and Kaptelenin and Nardi (2012) in that we do not divide affordances into different types. Instead, we provide three levels of affordances: individual, organizational and societal. To an extent Turner’s (2005) ‘complex’ affordances come close to our work, where the complex affordances are the ones that incorporate history and practice. As our conceptualization focuses on different types of settings (individual, organizational and societal) the notion of complex affordance can be applied to all the three levels in our definition of affordances.

4. Case Studies – Organizational Affordance

In the following we discuss two case studies where we have applied the Structuration Theory approach to study affordances. The first case is about the use of a budgetary system in the Dutch tax office and the second case is about the use of an intranet in a multinational bank. For the sake of brevity, we will not go into the details of these case studies and focus specifically on how the Structuration Theory approach to affordances can be applied to understand technology use in large organizations. We do not focus on describing the “formal” structure of the organization using frameworks proposed by organizational theorists such as Mintzberg (1980).

4.1. Case 1: Affordances of a Budgetary System

Using contextual interviews and in-situ observations, we investigated the use of a technology that supports budgetary processes within a large governmental organization (Chisalita 2006a, 2006b). The budgetary system in a public sector represents a static technology as it does not change much over time, i.e. both the functionality and design aspects are relatively stable. The process of budgeting is of great importance for a government of a country and several aspects of this process are subject of discussion in the parliament when laws are voted upon. The whole process is supported by a certain system used by people who are proposing a certain budget (the “controlled directorates”) and people who are controlling this budget to make sure that the numbers and policies behind the budget are correct (the “controlling directorates”). Both groups input data into the system. The data is used by the controllers to create reports about the status of the budgeting processes. Based on the data, negotiations about the budget take place, decisions are made and changes in the budget are approved.

In the following we will discuss the four conditions we have identified in this case followed by the discussion of affordances these conditions lead to.

Technological conditions

The system was developed by the management of the controlling directorate in order to support the budget controlling activity. Both the controlled and the controlling directorates needed to put numbers related to the budget in the system. The controlled directorates would make budget proposals while the controlling directorate would accept or propose changes to these numbers. A few months before the study, a new Windows-based version of the system was introduced in the directorate. The new version had improvements such as the insertion of short explanations regarding a proposed and/or accepted change in the budget in the system. The system was designed in such a way that any mistake in the budget cannot be undone unless an equivalent amount is detracted from the whole; in this way all mistakes were documented.

Cultural conditions

During the field study, we identified an “elite culture” in the controlling directorate with a number of important themes: pride and status (work was considered of national importance), competition, bullying, toughness, good atmosphere, “no-mistakes” culture. Within this “elite culture” we identified a number of subcultures: Specialists and People working with the system. The work of the “specialists” was focused on looking after the overall development of the budgetary policies. “People working with the system” (PwS) on the other hand were young employees, for whom working directly with the system was the main work. PwS seemed to be associated with low status and little recognition. There was a social norm which required the newcomers to work with the system – reinforcing the perception that the work with the system is of low status and value.

Power conditions

- *The control over the system*

The management controlled the design as well as the use of the system. It also controlled the access to the system as some parts of the system (lockets) were available only for a definite period of time. After this, no changes can be made in the system. For every phase in the budgeting process the management would write documents (‘directives’) that regulated the work and the way in which the system had to be used.

- *The discourse of the importance of “no mistakes” in the system use*

The management considered it to be very important that all inputs from PwS were accurate. To motivate the PwS, the management had introduced a reward system, where the PwS with the least errors would be rewarded with a trophy – symbolizing status and recognition.

- *The discourse of the importance of the work with the system*

The management considered the work with the system as an important part of the budgeting process; therefore, their goal was to “fight” the cultural norms and to change the attitudes of PwS towards the work with the system. The middle management mediated the influence of the top management. However, they preferred not to interfere in any way with the work with the system. They saw their role as exclusively managing policy issues.

Interpretive conditions

- *Knowledge about the system*

The top management had a lot of knowledge about the system; they influenced strongly its design and use. The middle management (the line management for the PwS) did not have knowledge about the system and they did not want to be involved in the work with the system. PwS had a lot of knowledge about the system and they were the ones that are actually using it. Specialists did not have the knowledge about the system and considered that it was not important to learn anything about it.

- *Attitudes toward the system*

All directorate members declared that the technology was important for the department. The system was considered clear, easy and efficient, It was an up-to-date and real-time system, therefore of value. However, it was very interesting to look at the attitudes towards the work with the system. While the top management declared the work with the system as important, what we saw at the floor level was that none of the other groups (middle managers, specialist or even the PwS) considered the work with the system to be associated with low status and less recognition. Moreover, the PwS interpreted the lack of knowledge of the middle managers as the lack of interest in the system.

Affordance: “History Pool of Employee Mistakes”

Using the Structuration Theory approach, we were able to study the affordances of the budgeting system. Our fieldwork showed that PwS made a large amount of mistakes while using the system, which had negative consequences for the budgeting process. This was quite surprising as the management had put effort into reducing human errors. This problem stemmed from a collection of the four conditions described above, which led the system to be perceived as a “history pool of employee mistakes”.

The elite culture placed great stress on the people in the department; they had to perform according to the very high standards, without any mistakes. The management tried to control and reduce the number of mistakes by different means, including changing the design of the system, through discourse and rewards. However, the work with the system was clearly associated (through cultural rules and interpretations) with low status and recognition. The fact that the direct superiors of PwS (the middle management) found the work with the system as not important reinforced the cultural issues. All these created a strong psychological pressure for the PwS who wanted to be perceived as elite but because they work with the system they are not.

Our analysis shows how the convergence of cultural, power, interpretive and technological conditions can lead to the emergence of an unwanted affordance. A certain design characteristic (the system is designed in such a way that any mistake in the budget cannot be undone unless an equivalent amount is detracted from the whole; in this way any mistake is documented and can be ‘overseen’ – technological condition) combined with an elite culture where there is no room for mistakes (culture condition) and with a situation in which managers are interested in overseeing all mistakes made with the system (power conditions) leads to the emergence of an interpretation of the system by the people working with it as a “history pool of employees mistakes”. From that moment on, this interpretation is also part of the interpretive conditions of the people working with the system. The perception of people working with the system is that the system becomes a transparent window affording exposure of their vulnerability in front of power structures (the managers). This in turn leads to a feeling of stress when using the system and a tendency to avoid working with it.

4.2. Case 2: Affordance of a Bank Intranet

The second case comes from an international bank study (Chisalita, 2006), in which the use of the internal support system (the Intranet within different branches of the bank) was studied. This case represents the use of a “dynamic” technology from a private sector. “Dynamic” technology refers to the fact that the applications and their content was very often changed (sometimes daily) making difficult to work with the system. Our focus was on a specific division that was concerned with private and commercial customers, with the goal of selling financial products and services to the customers. The division used advice offices, bank shops, ATMs, call centres and the Internet to offer products and services related to the assortment of banking, stock investment and insurance.

In the following we will present the four conditions we have identified in this case followed by the discussion on affordances these conditions lead to.

Technological conditions

At the time of the study there was a transition from a DOS-based system (the “old system”) to a Windows based system (the “new system”). This transition required a process in which applications were gradually transferred from one platform to another. As the rules and procedures of the bank changed, new applications were developed (and implemented only on the new Windows-based medium) and the old applications that did not correspond anymore with the new regulations were no longer officially allowed to be used. Over time, these applications were iteratively blocked in the old system. However, at a certain time certain applications were still available in the old system, the amount of time which they were open being determined by the managers of the bankshops (see Power conditions)

Cultural conditions

One of the main values of the bank were professionalism, integrity, respect, team work, all related to the goal of achieving customer satisfaction,

At the time of the study an interesting cultural development took place in the bank as the bank underwent a transition from a “service-oriented” bank to a “selling-oriented” bank. This transition required employees to show a more “pro-active attitude” and focus on selling more to the customers. One of the aspects implied was the reduction of the number of services provided by the employees to the customers. Instead, the customers would have to do these activities by themselves. In this way, employees won time and they could focus better on selling bank products and services to the customers.

In this process of change the bank has undergone a restructuration by firing 25% of the employees. The employees were given the possibility to choose to leave the organization or to stay if they accepted the new conditions.

What we have found in practice is that although the management of the bank made huge efforts to implement this change the results were only partially successful. It seems that two subcultures have formed in the bank:

- The “*selling-oriented*” subculture: the employees in this subculture have adapted to the new situation and took on the new role of selling more to the customers
- The “*service-oriented*” subculture: the employees in this subculture, although they have remained in the organization, have not adapted to the new culture. They still believed in the importance of helping customers to different services.

Power conditions

The system design and use was controlled by the Head Quarters (HQ) of the bank.. However, the managers of the bankshops had also some power as they were the ones who could allow the old applications to be available in the system, along with the new applications. The official rule was that the employees should use only the new applications and not the old ones. However, depending on his/her own convictions the managers of the bankshops allowed the access to certain applications. The managers declared that the reason to do this was to grant the employees time to learn the new applications while performing the tasks they were responsible for.

Interpretive conditions

The HQ had substantial knowledge of the system as all new applications were developed and implemented by the HQ. The employees had the difficult task to learn new applications while they were “on the move”, the applications being changed sometimes daily. The employees knew the old technology well and they felt comfortable using it.

The attitudes towards the system were positive, the employees considering that the system is important for performing their tasks. However, because there were so often changes in the system, they found it difficult to carry on their tasks in an effective way. Moreover, not being able to use the system properly due to the frequent changes they thought that they did not look professional in front of the clients, hence not being able in this way to fulfil one of the most important (declarative) values of the bank.

Affordance: “Use of forbidden services”

One of the most interesting ways in which the system was used, afforded by the conditions mentioned above, was to provide services for the clients which were not officially allowed anymore. The subculture we have identified as “service oriented”, the managers of the bank branches had a mediating role to decide whether to allow (or not) the old applications to run on the system. However, some of the employees used them anyway. For example, one subculture found within bank branches was “service oriented” (cultural condition) with a strong belief that clients should be served in the best possible way, opposed to the new management philosophy that required to sell as much as possible to clients. In certain technological conditions (some applications being still available in the old system), power conditions (managers allowing the old application to be kept into the system) and interpretive conditions (employees had the knowledge and skills to operate the older applications), employees used the technology to provide services that were no longer allowed by the management. For the service oriented subculture the old system afforded the possibility of fulfilling their values, even if these contradicted management regulations.

Both the case studies show how a certain enactment of a technology (under the four conditions) can shape affordances of the technology. The affordance of ‘history pool of employee mistakes’ in case study 1 and the affordance of ‘use of forbidden services’ in case study 2 represent two *snapshots* of how technology affordances have emerged over a specific period. A longitudinal observation of these two organizations may even show a change in these existing affordances and new technology use being emerged. It is interesting to note that while in the case study 2 the old technology did not change, its affordance as ‘use of forbidden services’ emerged as a consequence of the introduction of a new technology; that way the dynamics of affordance is clearly evident in the changing context.

5. What does this mean for Design?

Central to the Structuration Theory approach to affordance are the situated actions of users where affordances (conceptualized as ‘technology use’) emerge in practice. In this view, users’ interpretations and use of a technology can be different from what has been inscribed in it by the designers. The field of HCI has seen several similar theoretical notions such as situated actions (Suchman, 2007), ethnomethodologically informed ethnographies (e.g. Heath and Luff (1992)), and use of hermeneutics (Sengers and Gaver, 2006), where situated practices of users and their interpretations are given primacy. In the following we discuss our approach and show how this broader conceptualization of affordance can help in design.

5.1. Establishing Reflexivity through Design

Design introduces a level of reflexivity through physical and digital artefacts and not just what is said about them.

In pre-industrial society it was common to make your own tools (although even in Neolithic society there was mass production of flint articles, and later pottery and others). In traditional carpentry this was one of the jobs during an apprenticeship and the tools were made almost entirely of wood with only the cutting surfaces, or essential parts, like ferules to stop splitting, were made in metal. Well into the early years of the 20th century, bodgers (itinerant wood turners who made chair legs) would make their own lathes in a clearing in the forest where they cut the wood for their craft. Design thus evolved through use (technology-in-practice) and through a shared learning. In merchant society specialised artisan guilds developed, formalising tools and roles, sometimes through secret knowledge, sometimes through charters and legal restrictions. Tools are still often made by individuals, or inherited, but made to more standard forms. Even far from the organized guilds in towns and cities, country blacksmiths and carpenters use fairly standard sets of tools, through shared cultures in a much dispersed communities of practice. In industrial society tool making becomes a separate activity; tools are mass-produced, often alienating tool users and tools. Interestingly even in the industrial world the use of particular tools is a mark of being ‘in the club’. Often engineers, carpenters, brick layers, would have their own tools rather than use those supplied by an employer – in some ways offering autonomy, but also creating barriers to entry through long apprenticeships.

What we mean here is that artefacts speak about the culture within which they are designed and used. And the design of these artefacts evolves as the users, working-groups and culture evolve, over time. The three levels of affordances (user, organizational and societal) could be helpful to establish better reflexivity over the designed artefacts. Designers can modify certain aspects of their artefacts or design new artefacts to make it suitable for the users, the organization and the larger work culture. In some cases, the existence and prolonged use of certain artefacts could change users’ behaviour, the organization or the culture itself.

5.2. Control and Revolution – making things to influence people

Technology, tools, artefacts embody and enforce particular (not necessarily dominant) social, cultural and work-practice norms. These may be:

- explicit – the designer deliberately understands the social or work practice implications and builds the artefact in that knowledge

- implicit – there is no explicit knowledge, the designer just works within unspoken assumptions

In the case of explicit design, the designer may create an artefact that deliberately reinforces the norms, complies with the norms, or rejects/rebels against those norms (undermining them, perhaps explicitly or implicitly suggesting alternatives). The reasons for any of these may lie with the designer, in which case the values embedded are quite likely to reflect those of the designer or because she/he has been told/paid to do it in which case they may not be the designer's personal values. In the recent HCI research one can find several examples of explicit design utilizing the notions of sustainable energy consumption (Froehlich et al. 2010), ambiguity (Gaver et al. 2003), defamiliarization (Bell et al. 2005) as strategies for designing technological artefacts.

In the case of implicit design the embodied norm are almost certainly those of the designer, although the designer's own norms will be influenced by surrounding culture. Alternatively the artefact may simply poorly embody culture. Where the design occurs through adaptation by end users, it is most likely to be implicit. However, such designs react to emergent work practices and are thus likely to reflect the end-users' values and aspirations.

User of an artefact can choose to comply with these embodied norms, adapt them to their own purpose, or reject them (and possibly the artefact) entirely. Just like with the designer who embodies these social and cultural assumptions, the users' acceptance or rejection can be explicit or implicit. The enactment whether adaptive or revolutionary, of course itself becomes part of the reflexive design process and may become embodied in later designs – interestingly participatory design (ostensibly) seeks to effectively do some of this 'up front' during a single cycle of design and use rather over evolutionary design timescales.

Note in the Bank Intranet case, the design of the Windows based system was not only about adapting new technology, but also to impose a more sales-oriented culture on the employees. However, we saw how some employees subverted this by using the old DOS-based system.

5.3. Affordance as a Mediator and Product of Social Activity

Affordance can be described as a constantly changing and moving set of relationships around artefacts or technologies. Additionally, the 'dynamic' or the 'emergent' nature of affordance can be seen at all the 3 levels (user level, organizational level and societal level) of affordances, as described in section 3.3. During their interaction with artefacts users learn and adapt through the use of the artefact and/or through colleagues, other people and from the working situation itself.

In addition to understanding the relationship between the 3 levels of affordances, it is also important to see how these 3 levels of affordances could affect the design aspects. Let's take the classic example of door handles. At the user level affordances: designers may think about the size, grips and other ergonomically related aspects of the door handle. They may also consider some look-and-feel aspects for designing. At the organizational level (also the societal level): if the door is in an office situation, the designer may consider putting a sign about the presence or absence of the person inside. And in a public toilet, the door would show whether the toilet is vacant or occupied. Hence, at this level it's not just about grabbing the door handle but also considering the contextual settings. Clearly, one cannot think of a situation that is outside the social or societal level. So, in the real world applications all 3 levels of affordances need to be taken into account.

Our notion of affordance, influenced by the Structuration Theory, suggests that affordances are the mediator as well as the product of human actions. Affordance is a mediator in a sense that it offers, and at the same time constrains, action possibilities and opportunities to use the properties of a technology that are inscribed by designers. On the other hand, it is a social product of human actions, as through practices users develop new understanding of what the technology is and how to use it. The four conditions (technological, cultural, power, and interpretive), in combination, affect the emergence of affordances. We suggest HCI practitioners to take into account these conditions while designing systems for large organizations.

In some cases the technology does not always just allow or make things possible, but also encourages certain activities. For example, early work in media spaces focused on the way the systems enabled social awareness and social contact across space. These and indeed simple video conferencing, Voice over IP and instant messaging can be seen as at a person-to-person level affording remote contact, but also at an organizational level affording distributed working. At a wider level again, this means that an organization (considered as an entity) may be able to take part in global markets and so perform corporate actions that would be impossible without the technology.

5.4. Affordance of Organizational Structure

Pushing definitions even further, technologies do not just enable or encourage particular social actions, but also make possible, facilitate or promote social and organizational structures.

For example, early experience of email use in hierarchical organizations often caused problems because it allowed invisible communications both across the structure (someone in marketing emails someone in finance) and skipping levels (subordinate emails the CEO!). Middle management was often disempowered and resistant. Over time electronic communication has acted as an enabler of flatter organization structures.

In contrast, in the Budgetary System case study, we saw the opposite. The system clearly afforded an organizational activity of auditing, but also the effect of reinforcing a strong power structure. Similarly in the Bank Intranet the Windows system afforded an organizational activity (sales of financial products), but also was clearly intended to encourage a sales culture.

Note that like affordances of artefacts there is no technological determinism here. It would be possible for an organization to proscribe emails except within a department, or for the internal culture to be so strong this does not happen. That is, like physical affordances, certain things are in principle possible but the affordance may not be perceived, recognized or acted upon. The one important difference is that whereas at level 1 actions and effects of afforded actions are usually assumed to be intentional (although secondary effects may not be), in contrast at levels 2 and 3 (organizational and societal) the effects are often emergent based on lower level decisions. We saw that in both case studies where in the Budgetary System employees avoided using the system (presumably using paper for intermediate results until sure) whereas in the Bank Intranet the aim to encourage a sales culture was subverted by an alternative local sub-culture.

5.5. Critique

Have we taken the notion of affordance too far? If so then clearly some other term is required that encompasses both the level 1 affordances common in the literature and also broader level 2 and 3 effects. Whatever we call it, there is a continuity of phenomena where there is an

ecological fit between (i) natural objects and artefacts of all kinds from engineered tools, to software and even conceptual works, (ii) humans as individuals, small groups, organizations or whole societies, that potentially enables (iii) action, activity, maybe perception or even internal change (after all what is action but intentional change).

Taking this broader view entails a cross-disciplinary approach as is evident from the evolution of the term affordance from essentially perceptual foundations, through more cognitive psychology and more recently including roots such as late-Soviet philosophy. To this we have in addition brought a more organizational and human-interactive perspective, in particular Structuration Theory and also used case studies, although they can only illustrate a part of the bigger picture. The danger of this cross-disciplinarity is that it may be more confusing than enlightening and we hope we have avoided that in our treatment.

Certainly we are aware that it feels rather like a patchwork, where pieces from one field seem to parallel or recapitulate those from another. This is certainly problematic in trying to draw a narrative thread in a paper, but also emphasizes the continuity and interconnectedness of the multiple perspectives. This certainly reinforces our belief that there is a single broad phenomenon worthy of study.

It is important to acknowledge that while we have compared our Structuration Theory approach to affordances with other existing notions of affordances, we believe that our approach is similar to the Ricoeurian philosophy of hermeneutics (Ricoeur, 1976). Ricoeur's 'Interpretation theory' claims that interpretation is possible because of the difference between subjective intentions (e.g. intentions of an author of a book) and objective significance (what the text actually means to its readers). It is through interpretations that the difference between what is written and what is understood is solved. Our approach is similar to the Ricoeurian philosophy of hermeneutics in a sense that the notion of 'interpretive flexibility' within the Structuration Theory emphasizes the users' abilities to interpret and use a 'thing' in ways that can go beyond what the designers of that thing may have incorporated into its design. Hence, while we do acknowledge the similarity, we do not intend to make any contribution in the field of philosophy.

6. Conclusion

In this paper we showed that the notion of affordance needs to be treated considering group dynamics, in addition to the one-to-one level considering only the single user. When it comes to design, the user level affordances of a technology refer to the functionality, dialogue and representation of the technology. This requires understanding of the one-to-one relationship between a user and a system. However, dealing with the organizational and societal level affordances requires going beyond this one-to-one relationship and understanding the cultural and social effects on the human-technology interaction.

The two case studies suggest that even when a system is technologically functional, usable and efficient, there are social and cultural aspects that may affect the use of the system. Our notion of affordances, informed by Structuration Theory, allows designers to consider the broader impact their designed products could have in a socio-cultural context. This supports the HCI design processes in two ways: 1) it views users as active creators, and 2) it allows designers to focus beyond the one-to-one relationship between users and artefacts or technologies.

Gibson's original concept of affordance was coined as a descriptive term for the relational and ecological connection between perception and action. In the natural world the adaption of an organism to its environment, meant that this connection was 'immediate'. In HCI we deal with

constructed artefacts, often within built environments, and in social and organisational settings that are far from ‘natural’ in a species adaption timeframe; both the potential for action, Gibson's (1979) ‘affordance’, and the perceptual aspects of that, Norman's (1999) ‘affordance’, are designed. Whereas early work on affordance in HCI focused on the match between the (designed) perceptual features and action potential, more recent work including Sun and Hart-Davidsons (2014) and our own have recognised that the potential for action of specific technological artefacts and digital systems are shaped by the wider social and organisational environment, and hence understanding this relationship is a crucial and intrinsic aspect of the use of ‘affordance’ as a design construct.

Whether we use the term ‘affordance’ or something else, the growing body of work in this broader perspective, including our own, makes it clear that there are benefits in seeing the parallels between the different levels and kinds of ‘affordance’ and suggests that this is a valuable perspective for design.

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List of Figures:

Figure 1. The afford-dance – dynamics and evolution of affordance

Figure 2: A simple representation of Gidden's Structuration Theory

Figure 3: Organizational Affordances using the Structuration Theory